



Typical Applications

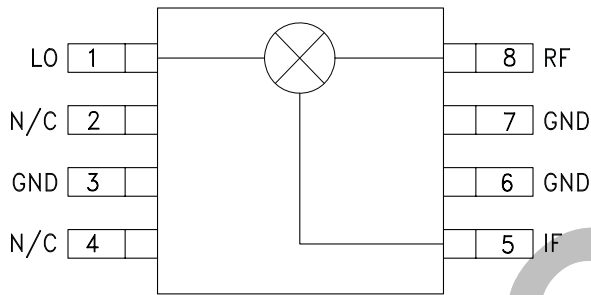
High Dynamic Range Infrastructure:

- GSM, GPRS & EDGE
- CDMA & W-CDMA
- Cable Modem Termination Systems

Features

- Input IP3: +31 dBm
- High Side LO
- Ultra Small MSOP8 Package: 14.8mm²
- No External Components
- Included in the HMC-DK002 Designer's Kit

Functional Diagram



General Description

The HMC402MS8 & HMC402MS8E are high dynamic range passive MMIC mixers in plastic surface mount 8 lead Mini Small Outline Packages (MSOP) covering 1.8 to 2.2 GHz. Excellent input IP3 performance of +31 dBm for down conversion and +27 dBm for up conversion is provided for 2.5G & 3G GSM/CDMA based UMTS or PCS applications at an LO drive of +17dBm. With a 1dB compression of +21 dBm, the RF port will accept a wide range of input signal levels. Conversion loss is 8.5dB typical and LO isolations are maintained at 24 to 30 dB. This miniature single-ended monolithic GaAs FET mixer does not require any external components or bias. The broad 50 to 500 MHz IF frequency response will satisfy many UMTS/PCS transmit or receive frequency plans configured for high side LO. The HMC402MS8(E) input IP3 performance coupled with its high P1dB rivals traditional active FET mixers while offering a much smaller 14.8mm² standard IC footprint, and no DC bias.

Electrical Specifications, $T_A = 25^\circ\text{C}$, LO = +17 dBm, IF = 300 MHz*

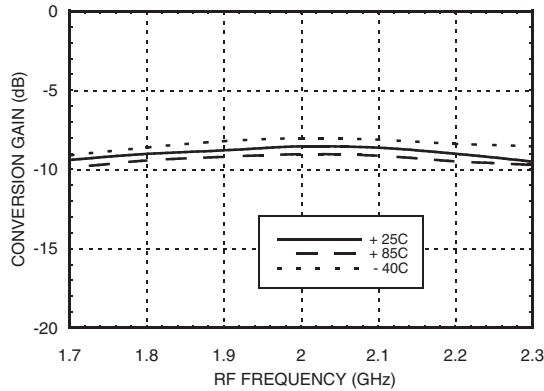
| Parameter | Min. | Typ. | Max. | Min. | Typ. | Max. | Units |
|--------------------------------|------------|------|-------------|------|------|------|-------|
| Frequency Range, RF | 1.8 - 2.0 | | 2.0 - 2.2 | | | | GHz |
| Frequency Range, LO | 1.85 - 2.5 | | 2.05 - 2.53 | | | | GHz |
| Frequency Range, IF | DC - 500 | | DC - 330 | | | | MHz |
| Conversion Loss | | 8.8 | 10.5 | | 8.5 | 10.5 | dB |
| Noise Figure (SSB) | | 8.8 | 10.5 | | 8.5 | 10.5 | dB |
| LO to RF Isolation | 24 | 30 | | 21 | 25 | | dB |
| LO to IF Isolation | 19 | 24 | | 24 | 28 | | dB |
| IP3 (Input) | 27 | 30 | | 27 | 31 | | dBm |
| 1 dB Gain Compression (Input) | 18 | 21 | | 18 | 22 | | dBm |
| LO Input Drive Level (Typical) | +16 to +18 | | +16 to +18 | | | | dBm |

*Unless otherwise noted, all measurements performed as a downconverter with high side LO & IF = 300 MHz.

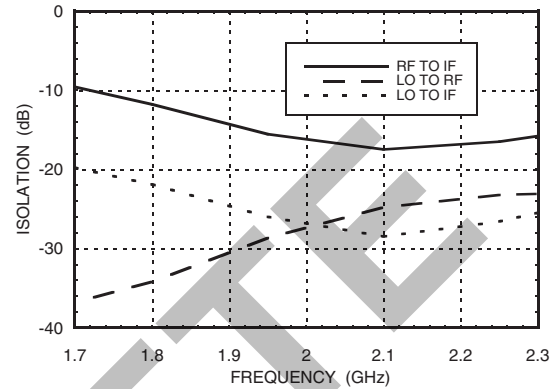
HIGH IP3 GaAs MMIC MIXER, 1.8 - 2.2 GHz



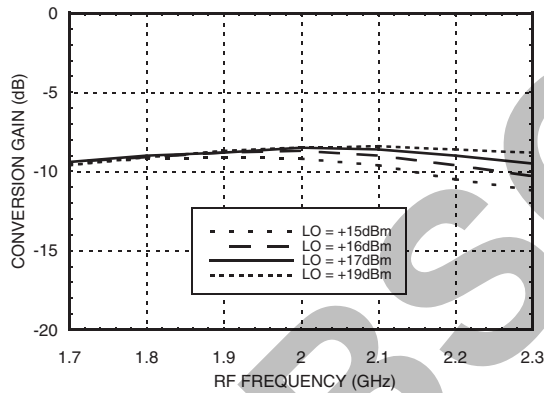
Conversion Gain vs. Temperature @ LO = +17 dBm



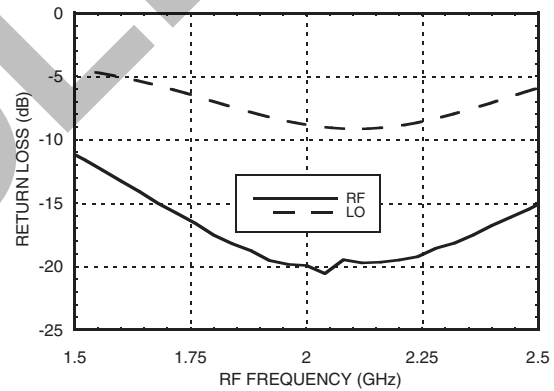
Isolation @ LO = +17 dBm



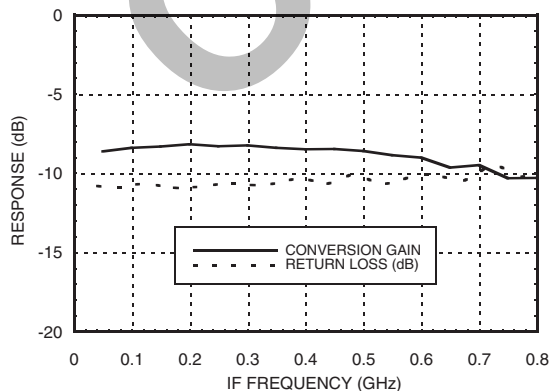
Conversion Gain vs. LO Drive



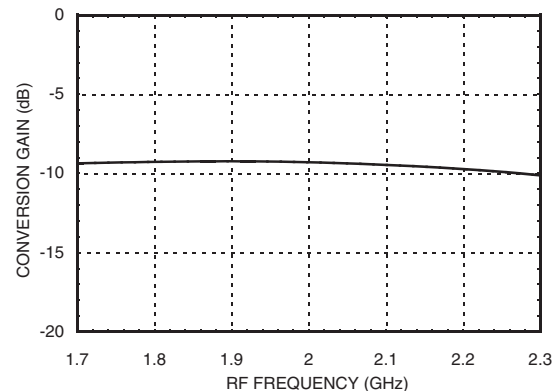
Return Loss @ LO = +17 dBm



IF Bandwidth @ LO = +17 dBm



Unconverter Performance Conversion Gain @ LO = +17 dBm



*Unless otherwise noted, all measurements performed as a downconverter with high side LO & IF = 300 MHz.

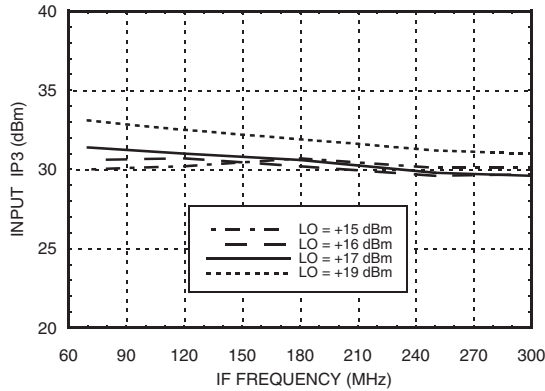
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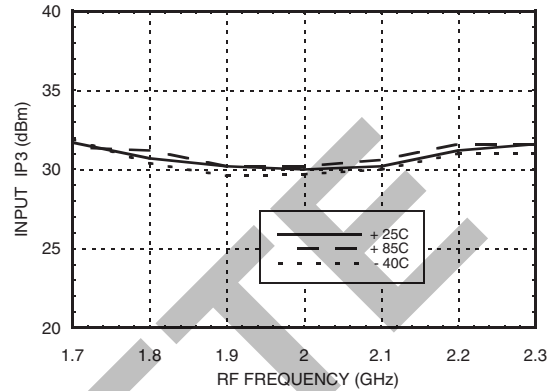


**HIGH IP3 GaAs MMIC
MIXER, 1.8 - 2.2 GHz**

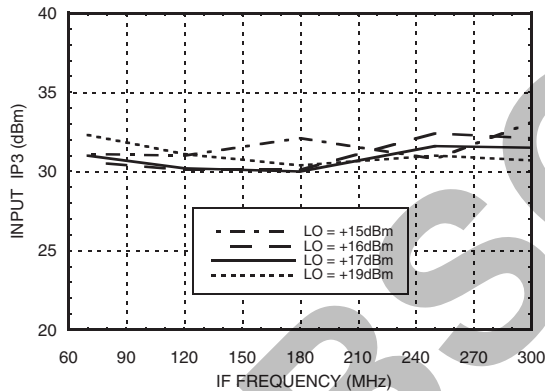
**Input IP3 vs.
IF Frequency, RF = 1.95 GHz**



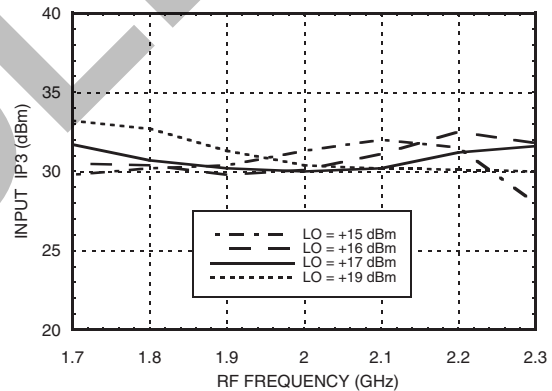
**Input IP3 vs.
Temperature @ LO = +17 dBm**



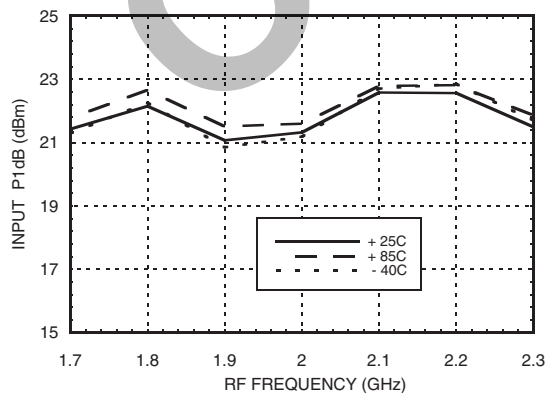
**Input IP3 vs.
IF Frequency, RF = 2.15 GHz**



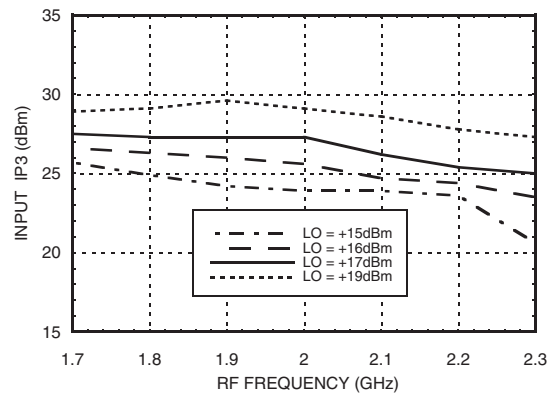
Input IP3 vs. LO Drive



**Input P1dB vs.
Temperature @ LO = +17 dBm**



**Upconverter IP3 vs.
LO Drive, IF = 200 MHz**



*Unless otherwise noted, all measurements performed as a downconverter with high side LO & IF = 300 MHz.

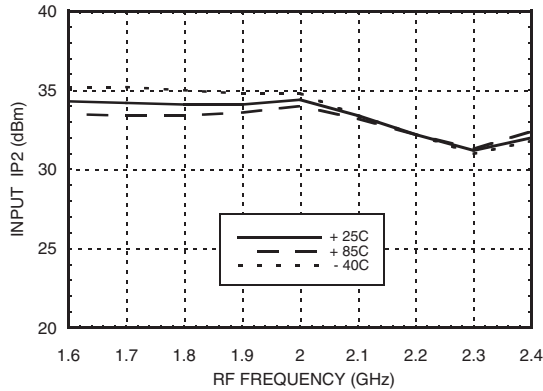
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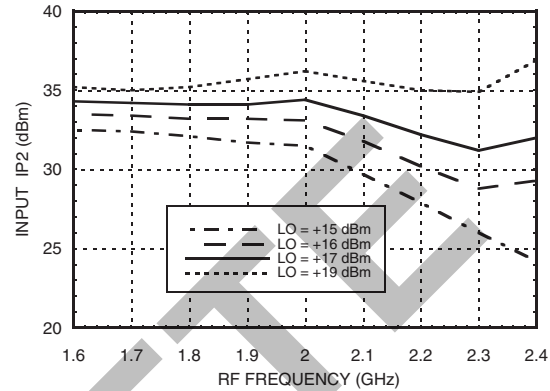
HIGH IP3 GaAs MMIC MIXER, 1.8 - 2.2 GHz



Input IP2 vs. Temperature @ LO = +17 dBm



Input IP2 vs. LO Drive



MxN Spurious Outputs

| mRF | nLO | | | | |
|-----|-----|----|----|----|----|
| | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | -7 | -3 | -1 | 11 |
| 1 | 5 | 0 | 27 | 54 | 30 |
| 2 | 62 | 64 | 48 | 65 | 70 |
| 3 | 81 | 81 | 82 | 81 | 80 |
| 4 | 77 | 81 | 80 | 83 | 82 |

RF Freq = 1.9 GHz @ -10 dBm
LO Freq = 2.2 GHz @ +17 dBm
All values in dBc relative to the IF power level.
Measured as a downconverter.

Harmonics of LO

| LO Freq (GHz) | nLO Spur @ RF Port | | | |
|---------------|--------------------|----|----|----|
| | 1 | 2 | 3 | 4 |
| 1.8 | 40 | 30 | 51 | 57 |
| 2 | 30 | 29 | 51 | 53 |
| 2.2 | 26 | 32 | 51 | 50 |
| 2.4 | 24 | 36 | 53 | 49 |
| 2.6 | 23 | 43 | 59 | 53 |
| 2.8 | 22 | 41 | 51 | 71 |

LO = +17 dBm
All values are in dBc below input LO level @ RF port.

Absolute Maximum Ratings

| | |
|-----------------------|----------------|
| RF/IF Input | +27 dBm |
| LO Drive | +27 dBm |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |
| IF DC Current | ±40 mA |



**ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS**

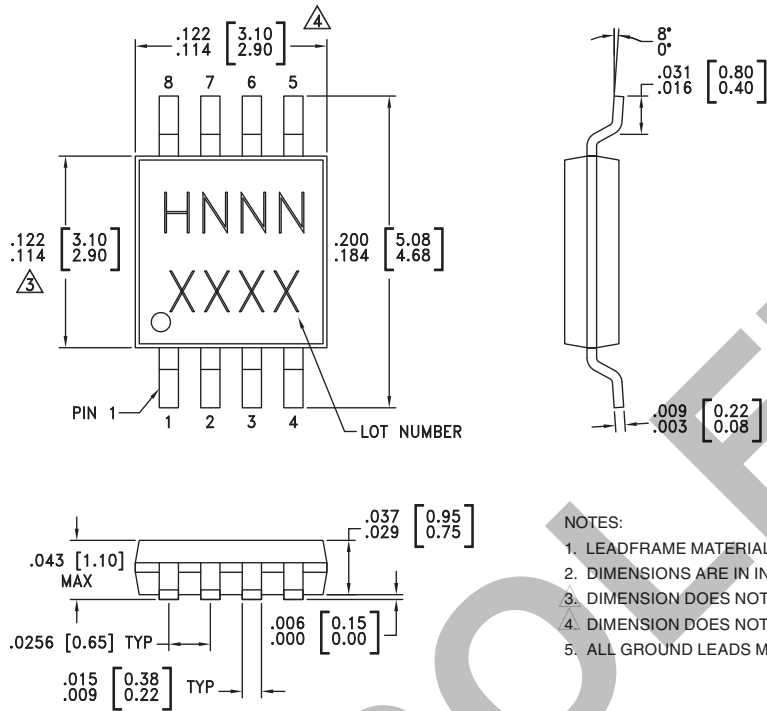
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Outline Drawing



- NOTES:
1. LEADFRAME MATERIAL: COPPER ALLOY
 2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
 3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
 4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
 5. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

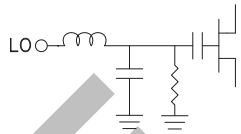

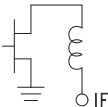
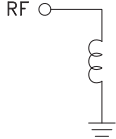
Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[3] |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC402MS8 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 ^[1] | H402 XXXX |
| HMC402MS8E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 ^[2] | H402 XXXX |

[1] Max peak reflow temperature of 235 °C
 [2] Max peak reflow temperature of 260 °C
 [3] 4-Digit lot number XXXX

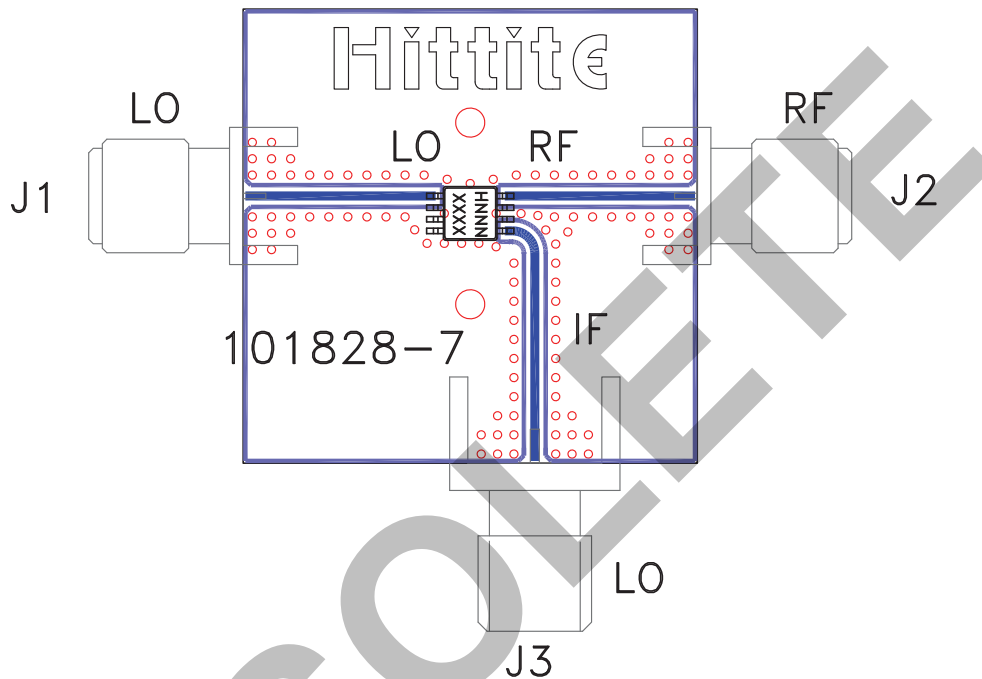


Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|------------|----------|---|--|
| 1 | LO | This pin is AC coupled & matched to 50 Ohms from 1.8 to 2.2 GHz. Blocking capacitors are required if line potential is not equal to 0V. |  |
| 2, 4 | N/C | Not connected. | |
| 3, 6, 7 | GND | This pin must be connected to RF ground. |  |
| 5 | IF Port | This pin is DC coupled. For applications not requiring operation to DC this port should be DC blocked externally using a series capacitor. Choose value of capacitor to pass IF frequency desired. For operation to DC, this pin must not sink/source more than 40 mA of current or failure may result. |  |
| 8 | RF Port | This pin is DC coupled & matched to 50 Ohms from 1.8 to 2.2 GHz |  |



Evaluation PCB



List of Materials for Evaluation PCB 101830 [1]

| Item | Description |
|---------|------------------------------|
| J1 - J3 | PCB Mount SMA RF Connector |
| U1 | HMC402MS8 / HMC402MS8E Mixer |
| PCB [2] | 101828 Eval Board |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the final application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Hittite upon request.

**Notes:**

OBSOLETE

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